

Some Observations on *Ischaemum indicum* (Poaceae: Panicoideae: Andropogoneae)
a Recent Aggressive Introduction to Costa Rican Pastures Lands¹

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ABSTRACT

Ischaemum indicum (Houtt.) Merrill, a grass originally from the Indian subcontinent, has only recently colonized Costa Rica. Of agronomic interest is the rapid proliferation of this species and its ability to dominate other grasses and plants under open (non-forested) situations.

Data from sample plots and farmer interviews have demonstrated the aggressive nature of *I. indicum* under humid tropical conditions in Costa Rica. Observations suggest the possibility of further expansion of the habitat range of this species throughout Central America.

Suggestions as to possible management as a pasture grass are included.

INTRODUCTION

Examples of the distribution, by human influence, of almost every variety of cultivated plant far from its area of origin are legion (1, 10). Since we depend on plants either directly or indirectly in order to live, this attempt to experiment with as many different species as possible in a variety of distinct environments is a natural one. The grass *Ischaemum indicum* (Houtt.) Merrill, locally called "retana", "ratana" or more commonly "rotana", originally from the Indian subcontinent, began to colonize Costa Rica in the very recent past. Whether this was a planned introduction, in an effort to improve grazing capabilities, or a chance invasion is

COMPENDIO

Ischaemum indicum (Houtt.) Merrill, es un zacate endémico del subcontinente Indio, conocido localmente como "rotana", ha sido introducido recientemente en Costa Rica y ha colonizado extensas áreas del país. Resulta de interés agronómico la rápida propagación de esta especie y su habilidad de dominar otras hierbas y gramíneas en ambientes abiertos (no-forestales).

La información obtenida de muestras de campo y de entrevistas con finqueros, indica que *I. indicum* es muy agresivo bajo las condiciones del trópico-húmedo de Costa Rica. Basado en observaciones de su dominancia sobre otras hierbas, se puede contemplar sobre la posibilidad de su expansión en corto plazo en toda la América Central.

Se incluyen sugerencias sobre un mejor manejo agronómico de esta gramínea como un pasto permanente.

difficult to ascertain. What is known is that this species is now firmly established in Costa Rica.

Costa Rica is located between 8 and 11 degrees north of the equator on the Central American isthmus, north of Panama and south of Nicaragua (Fig. 1). It has a northwest to southeast orientation and is bounded to the east by the Caribbean and to the west by the Pacific ocean. Its principal physiographic characteristic is a series of volcanic mountain ranges also running in a northwest to southeast direction. This central mountain backbone acts to divide the country into the eastern (Caribbean) humid region and the western (Pacific) dry region. However, while the western zone has an extended dry season (Monsoonal) the annual rainfall there is seldom less than 1 400 mm. High temperatures coupled with high precipitation in these latitudes are conducive, under normal conditions, to the growth of forests. Indeed, even as much as four and a half centuries after the arrival of Europeans, according to Powell (9), "nearly nine-tenths of the Republic (of Costa Rica) are forested and there are an estimated 48 million board feet of lumber."

Since a large part of the one-tenth which was not forested was planted to either food crops, coffee, bananas or cacao, pastures and grasslands were not of a high level of importance in the local agriculture of that date. Stanley (11) conducted field work in

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I also appreciate the assistance provided by Allen M. Young. Tammy Kuczynski prepared the map of Central America.

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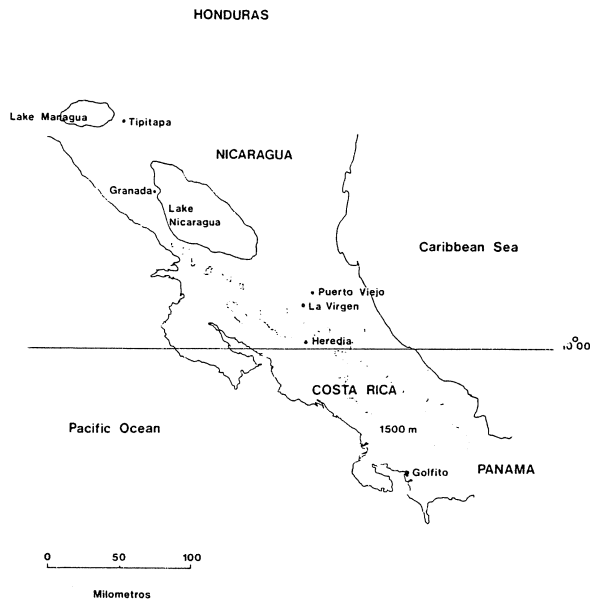


Fig. 1. Location of Costa Rica showing the Puerto Viejo and La Virgen sites.

Costa Rica during the winters of 1923-24 and 1925-26. In the introduction to his four volume publication, he makes little mention of grasses except in relation to the dry Pacific-northwest. He attributes a great deal of the extension of grassland there to the practice of annual burning. *I. indicum* is not included in his study. Hitchcock (3) also makes no mention of this grass in his volume, "Grasses of Central America."

By 1975, due to intense population pressure on available land resources, only 25% of Costa Rica could be classified as forest (4) and today this figure is considerable lower. Thus, a much larger habitat conducive to the growth and spread of grasses has been developed, in a relatively short time span, through the elimination of forests. Much of this change in land use is attributable to an economic situation favorable for livestock development, and Hall (2) has documented this increase in both meat and milk production in Costa Rica, along with the expansion of lands devoted to pastures.

Pohl (8) indicated that the earliest collection he made of *I. indicum* in Costa Rica was from the grass garden at CATIE, Turrialba in August, 1966. This voucher specimen is at the Herbarium of the Iowa State University at Ames. Subsequently, he stated with regard to this species (8) that the "only Costa Rican collection (at the Field Museum in Chicago) is the following: Puntarenas, Golfito: very common on

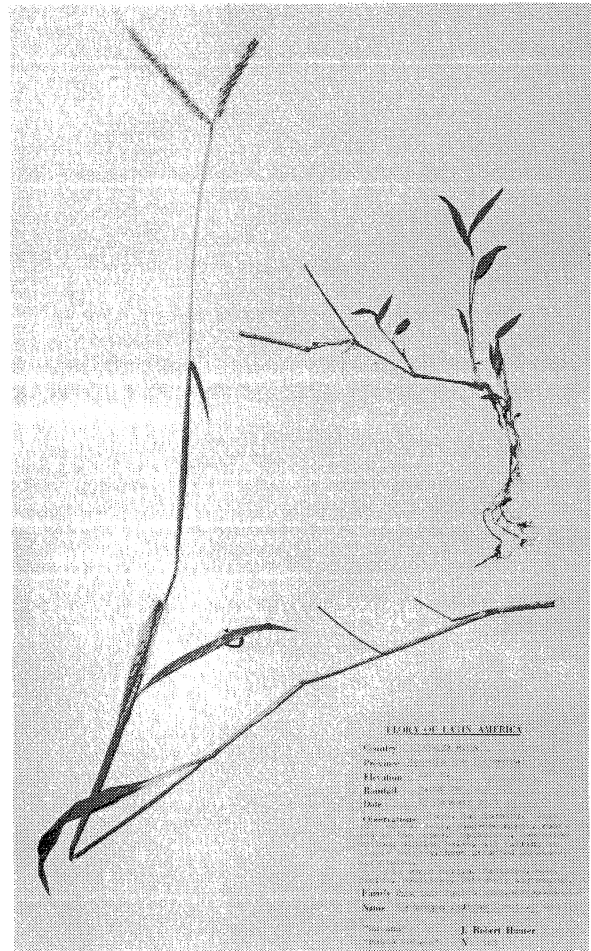


Fig. 2. Sheet corresponding to the specimen 565 collected near Sarapiquí, Costa Rica.

sand along a stream, elevation 2M. 11 December 1968. P & D 11571. Introduced from the Old World and reported from Panama and Guyana."

The Herbarium at Iowa State University also has two sheets from Panama (Nee 9007, 1973 and Folsom & Collins 6427, 1977), both collected from roadsides. There is another sheet from Trinidad obtained in 1982 - Harriman 17516. A further sheet (1981) was made from specimens collected near Las Cañas, Costa Rica, where this grass had been planted for forage. There it was called "pasto ratana."

The Herbarium at the Museo Nacional in San Jose contains the following collections: Pohl 11571, 11 December 1968, Golfito; Pohl 13195, 7 June 1976, Sixaola; Ocampo 3086, 1981, Talamanca; Judziewicz 4325, 6 November 1983, La Selva; Gómez-Laurito 9703, 14 January 1984, San Ramón; Hunter 565, 15 January 1985, La Tirimbina (Fig. 2).

In a three year study of tropical succession carried out from 1969 through 1972, in the humid lowlands of Costa Rica near the town of Puerto Viejo de Sarapiquí (5), not a single example of this grass was encountered among the hundreds of voucher samples taken. In the studies of lowland succession which Opler, Baker and Frankie (7) conducted in wet land (Finca La Selva, also near the town of Puerto Viejo) and dryland (5 km northwest of Las Cañas) sites, of the thousands of species collected and identified, not one was *I. indicum*. Only a few years later, however, Judziewicz and Pohl (6) collected some samples of *I. indicum* just to the south of the entrance to the La Selva Station and concluded that, while introduced from the Old World, it was "apparently becoming fairly common in pastures in lowland Costa Rica."

This information suggests that the grass in question is a very recent import to Costa Rica. However, there is so much hearsay that it is difficult to provide exact dates and localities of its introduction. Reports of immigration from Panama clash with those of a Nicaraguan origin. Montiel (personal communication, 1985) of the Facultad de Agronomía of the Universidad de Costa Rica, felt that it had been introduced from Colombia, but there were no data as to who brought *I. indicum* into the country or when. No one has made a positive claim of any kind concerning the importation of this species. Furthermore, no one estimates its establishment earlier than the decade of the 1960s.

Growth and habitat characteristics of *Ischaemum indicum*

This is a mat-forming grass, rooting at the nodes. In addition to this vegetative system of propagation, it is a prolific seed producer. The inflorescence consists of two spreading racemes reddish in color. Although day length at this latitude is minor, *I. indicum* is obviously a short day plant with flowering

beginning in the northern hemisphere in late November and lasting through January or February. Newly established mats of the plant are readily identified by reddish congregations of inflorescences between 15 and 20 cm in height

During flowering, this grass is very unpalatable to cattle and horses. Limited observations have not shown that it is a food of choice by any seed-eating birds.

L. Poveda (personal communication, 1985) of the Universidad Nacional in Heredia and the Museo Nacional has suggested that its dominating habit may be due to some inhibitory substance secreted from the roots, but there is no concrete evidence of this.

It does not appear to be at all demanding of topography or soil type. Table 1 gives the soil analyses of two different sites in which species comparisons were made during successive years.

During 1984 and 1985, this grass was observed in Costa Rica from sea level to 1 500 m in elevation and under rainfall regimes varying from as much as 4 500 mm to as low as 1 650 mm. It was also noted in the spring of 1985 between Granada and Tipitapa in Nicaragua; there I was informed that it had been reported as invading lowland pastures farther north, up to and including Honduras.

METHODS

I first learned of *I. indicum* in 1983, and was sufficiently impressed with its aggressive characteristics by early 1984 to initiate a series of observations on its performance in tropical lowland situations.

Two pastures were selected in the northeastern part of Costa Rica near the town of La Virgen de Sarapiquí for study. The first was of the traditional

Table 1. Some chemical properties of the soils under two different pastures in the lowlands of northeastern Costa Rica.

Soil Sample	pH	OM %	Al	Ca Meg/100 g	Mg	K	P ppm
Slash-and-burn							
0 - 10 cm	4.1	6.25	2.70	1.7	0.7	0.10	2.5
10 - 40 cm	4.3	4.7	1.50	2.1	1.1	0.15	2.0
Planted Pasture							
0 - 10 cm	4.5	8.50	2.60	1.50	0.6	0.13	2.0
10 - 40 cm	4.7	9.38	1.20	3.0	1.8	0.12	2.0

Table 2. Numbers of plants (by species – alphabetical by family) identified in four 1 m² plots in a slash-and-burn pasture in the humid lowlands of Costa Rica in two successive years.

Species	Number of Individuals	
	January 1984	January 1985
Acanthaceae		
<i>Blechnum brownii</i> Juss	10	2
Amaranthaceae		
<i>Cyathula achyranthoides</i> (HBK) Moq	34	6
<i>Cyathula prostrata</i> (L.) Blume	5	
Commelinaceae		
<i>Campelia zanonii</i> (L.) HBK	18	
Cyperaceae		
<i>Cyperus</i> sp. 1	10	2
<i>Cyperus</i> sp. 2	18	7
Labiatae		
<i>Hyptis captata</i> Jacq	3	
Melastomataceae		
<i>Clidemia dentata</i> D. Don	8	14
Mimoseae		
<i>Mimosa pudica</i> L.	42	16
<i>Pentaclethra macroloba</i> (Willd.) Kuntz	1	
Myrtaceae		
<i>Psidium guajava</i> L.	2	
Poaceae		
<i>Andropogon bicornis</i> L.	3	
<i>Axonopus compressus</i> (Sw.) Beauv	62	6
<i>Digitaria ciliaris</i> (Ritz.) Koel.	13	
<i>Ischaemum indicum</i>	8	762
Genus sp. 1	42	13
Rubiaceae		
<i>Hamelia patens</i> L.	14	2
<i>Sabicea villosa</i> R. and S.	2	
Solanaceae		
<i>Solanum umbellatum</i> Mill	8	3
also		
<i>Pteridium</i> sp.	43	14

type for this region, developed by cutting down the forest, then burning the refuse when possible, or just leaving everything to decompose. Once the area was fenced, cattle were turned in to fend for themselves. Here, the hope is that the animals will trample down the trash and organic matter and thus provide a habitat which grasses present in the immediate vicinity can easily invade. This strategy is aided from

time to time (but rarely more than three times a year), by sending in men with machetes to cut down the persistent woody successional weeds, the shade of which could impede the growth of any grasses present. This pasture was established in 1963.

The other pasture was one in which attempts had been made to actually plant a forage of recognized

worth and eliminate by means of herbicides as much of the weedy growth as possible, at least in the establishment stage. In this case, the pasture grass, *Cynodon nlemfuensis* Vanderyst, locally known as "estrella" or "estrella africana" is a persistent plant in its own right, spreading extensively by stolons and rhizomes, as well as by seed. This pasture was established in 1976.

During January of 1984, four randomly selected 1 m² plots were staked in the two different lots. This gave a total area of four square meters in each pasture from which a census was taken of all plants encountered. These data are presented in Table II

In January of 1985, four new randomly selected plots each 1 m² were staked out in each pasture. As

during the preceeding year, a tally was made of the different species encountered in the total of four square meters for each pasture. These data are presented in Table III.

In addition to these analyses, a survey was made of twenty cattlemen in an area ranging from Puerto Viejo de Sarapiquí to Ciudad Quesada, some 50 km to the west. The basis of the survey was a questionnaire which included questions about when the grass first appeared. Was it introduced and if so by whom? What is the best type of management? What is the best means of establishment? What is known of the nutritional value? How does it compete with other pasture grasses? With other plants? What is the observed palatability for cattle and horses? Also included was information as to locality, altitude,

Table 3. Numbers of plants (by species – alphabetical by family) identified in four 1 m² plots in a slash-and-burn pasture in the humid lowlands of Costa Rica in two successive years.

Species	Number of Individuals	
	January 1984	January 1985
<i>Amaranthaceae</i>		
<i>Cyathula achyranthoides</i> (HBK) Moq.	8	
<i>Commelinaceae</i>		
<i>Campelia zanonía</i> (L.) HBK	14	
<i>Cyperaceae</i>		
<i>Cyperus</i> sp. 1	16	2
<i>Cyperus</i> sp. 2	11	4
<i>Labiatae</i>		
<i>Hyptis captata</i> Jacq.	4	
<i>Melastomataceae</i>		
<i>Clidemia dentata</i> D. Don	7	11
<i>Mimoseae</i>		
<i>Mimosa pudica</i> L.	23	7
<i>Poaceae</i>		
<i>Axonopus compressus</i> (Sw.) Beauv.	18	6
<i>Cynodon nlemfuensis</i>	462	46
<i>Ischaemum indicum</i>	27	426
<i>Genus</i> sp. 1	4	
<i>Rubiaceae</i>		
<i>Hamelia patens</i> L.	9	
also		
<i>Pteridium</i> sp.	23	8

rainfall, how long the farm had been established, whether its primary purpose was for dairy, fattening or cow-calf operations, and so on

Every farmer contacted was quite willing to give his opinion about this grass. A summary of these observations is included below.

RESULTS AND DISCUSSION

Based on the data gathered from the pasture census, the rapid colonization of *I. indicum* in two different pastures in the humid tropical lowlands of Costa Rica, within the period of only one year, is quite obvious. It is clear that an exotic grass, which until very recently had not even been recorded in the literature, has become one of the dominant species in this region.

With regard to the farmer interviews, all agreed that *I. indicum* is a most aggressive competitor and that within a very short time has become one of the predominant grasses in the area. They split into three groups as to their opinion of its value and how to deal with this recent intruder

The first group, which included four university-trained agronomists, felt it was unfortunate that this species had ever reached Costa Rica and that every possible effort should be taken to eradicate it. They said that it was dominating and eliminating the grasses they had planted for forage, such as *Axonopus scoparium* (Fluegge) Kuhl., *Bracharia mutica* (Forsk.) Stapf, *Cynodon dactylon* (L.) Pers., *C. nlemfuensis*, *Panicum purpurascens* Raddi and even *Panicum maximum* Jacq. These farmers felt quite strongly that *I. indicum* was not a satisfactory forage grass, even though it was very aggressive.

The second and largest group believed that "rotana" was a fortuitous introduction, since it established itself so rapidly in newly cleared land. This group reported that *I. indicum* was able to dominate not only common weeds in pastures but also such persistent plants as *Coix lacryma-jobi* L. Although cattle and horses would not eat *I. indicum* when it was in flower, these ranchers agreed that their animals could generally find something else to tide them over until the "rotana" became more palatable

The third group, consisting of a single lowland dairy farmer, insisted *I. indicum* was so thoroughly established that instead of hoping to eradicate it (a very expensive task), the best alternative would be to learn how to manage it for year-around pasturage. He suggested that probably the most important management practice would be to cut or pasture

the grass early in November to prevent flower formation and thus keep the mats in vegetative condition.

Despite any attempts to eliminate this grass, it is apparent that *I. indicum* will soon dominate a great deal of lowland pasture as well as abandoned open fields and roadsides, particularly in the more humid regions of Costa Rica up to an altitude of 1 500 m. There is evidence that it is now on the way to dominating non-forested areas in other regions of Central America. From an agronomic standpoint, the most reasonable approach for dealing with this recent exotic invader is to understand its behavior under different ecological conditions so as to learn how to manage it for optimum milk and meat production.

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